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Dividends From Wood Research

Recent Publications

July–December 1999

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Explanation and Instructions

"Dividends From Wood Research" is a semiannual listing of recent publications resulting from wood utilization research at the Forest Products Laboratory (FPL). These publications are produced to encourage and facilitate application of Forest Service research. This issue lists publications received between July 1 and December 31, 1999.

Each publication listed in this brochure is available through at least one of the following sources.

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List of Categories

Publications are listed in this brochure within the following general categories:

Biodiversity and Biosystematics of Fungi

Preservation of Tropical Wood-Inhabiting Basidiomycetes

Croan, Suki, C.; Burdsall, Harold H., Jr.; Rentmeester, Rita, M.
1999. Mycologia. 91(5): 908–916

Decay Processes and Bioprocessing

A New Approach to Effective Biopulping: Treating Logs With *Phlebiopsis gigantea*

Blanchette, Robert A.; Behrendt, Chad D.; Williams, Diane; Iverson, Sara; Akhtar, Masood; Enebak, Scott A.
1998. *In*: Proceedings, 7th international conference on biotechnology in the pulp and paper industry; 1998, June 16–19; Vancouver, BC, Canada. Oral presentations, Vol. A: A51–A54.

CCA Removal From Treated Wood by Chemical, Mechanical, and Microbial Processing

Clausen, Carol A.; Smith, Robert L.
1998. *In*: The challenge safety and environment in wood preservation—Sec. 5, Environmental aspects. Proceedings, 4th international symposium of the International Research Group on Wood Preservation; 1998 February 2–3; Cannes–Mandelieu, France: 334–344.

Long-Term Appraisal of On-Site Preservative Treatments for Preventing Decay in Exterior Woodwork

Highley, Terry L.; Scheffer, T.C.
1998. Mater. und Org. 32(1): 29–40.

Control of Wood Decay by *Trichoderma* (*Gliocladium*) *virens*—II. Antibiosis

Highley, Terry L.; Padmanabha, H.S Anantha; Howell, C.R.
1997. Mater. und Org. 31(3): 157–166.

Applied Biological Research

Jeffries, Tom; Himmel, Mike.
1998. *In*: Finkelstein, Mark; Davison, Brian, H., eds. Proceedings, 19th symposium on biotechnology for fuels and chemicals; 1997 May 4–8; Colorado Springs, CO. Appl. Biochem. Biotechnol. 70–72: 113–114.

Disruption of the Cytochrome *c* Gene in Xylose-Utilizing Yeast *Pichia stipitis* Leads to Higher Ethanol Production

Shi, Nian–Qing; Davis, Brian; Sherman, Fred; Cruz, Jose; Jeffries, Thomas W.
1999. Yeast 15: 1021–1030.

Organization and Differential Regulation of a Cluster of Lignin Peroxidase Genes of *Phanerochaete chrysosporium*

Stewart, Philip; Cullen, Daniel
1999. J. Bacteriol. 181(11): 3427–3432.

Durability

In-Service Moisture Content of Hardboard Lap Siding in Southern Florida

Carll, C.; TenWolde, A.; Malinauskas, V.; Knaebe, M.; Sotos, P.G. 1999. *In*: Lacasse, Michael A.; Vanier, Dana, J., eds. Service life and durability of materials and components. Vol. 1. Proceedings, 8th international conference on durability of building materials and components; 1999 May 30–June 3; Vancouver, Canada. Ottawa, Canada: NRC Research Press: 680–692.

▷ 1. Ten-Year Performance of Treated Northeastern Softwoods in Aboveground and Gound-Contact Exposures

Crawford, Douglas M.; De Groot, Rodney C.; Gjovik, Lee R.
1999. USDA Forest Serv. Res. Pap. FPL–RP–578. 9 p.

The commercial value of several softwood species of the northeastern United States could be increased if these woods could be treated to meet existing American Wood Preservers' Association Standards and used in durable structures. We evaluated the long-term durability of incised and unincised white pine, red pine, eastern spruce, balsam fir, and eastern hemlock treated with ammoniacal copper arsenate (ACA) and chromated copper arsenate (CCA–Type C). The treated wood was exposed above ground and in ground contact in the southern and northeastern United States. Simulated decks were tested above ground in Cumberland, Maine, and Amherst, Massachusetts. Stakes were tested in ground contact in Saucier, Mississippi, and Cumberland, Maine. Replicates of all test species and conditions, including untreated controls, were represented in the test plots and decks. Both the stakes and deck material were monitored annually for structural condition and appearance. After 10 years of aboveground exposure, all untreated decks (controls) failed as a result of decay. Wood treated with CCA showed somewhat better durability than did wood treated with ACA. Except for white pine, treated incised wood species showed no evidence of decay. Incised white pine treated with ACA failed by excessive checking. Unincised white pine treated with CCA also failed, as a result of transverse scaling and radial checking. In ground-contact field trials, failure patterns of untreated stakes showed more differences than did performance patterns of treated stakes at different exposure sites. Overall, these results suggest that treated northeastern softwood species could be used for durable construction.

Doss More Preservative Mean a Better Product?

De Groot, Rodney C.; Evans, James
1999. Forest Prod. J. 49(9): 59–68.

▷ 2. Air Drying of Lumber

Forest Products Laboratory
1999. USDA Forest Serv. Gen Tech. Rep. FPL–GTR–117. 62 p.

This report describes how lumber can be air-dried most effectively under outdoor conditions and illustrates the principles and procedures of air-drying lumber that were developed through field investigations and observations of industrial practices. Particular emphasis is placed on the yarding of lumber in unit packages. Included are topics such as why lumber is dried, advantages and limitations of the drying process, properties of wood in relation to drying, layout of the drying yard, piling methods, causes and remedies of air-drying defects, and protection of air-dried lumber.

▷ 3. Effect of Prestain on the Release Rate of Copper, Chromium, and Arsenic From Western Hemlock

Lebow, Stan T.; Evans, James W.
1999. USDA Forest Serv. Res. Note FPL–RN–0271. 6 p.

To enhance appearance, stains are often sprayed onto western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) lumber prior to treatment with chromated copper arsenate (CCA-C). Recently, concerns have increased that prestaining may affect the rate of leaching of CCA-C components from the treated wood and that leaching data generated with prestained material may not reflect the rate of release from nonstained wood. A secondary concern is that copper naphthenate field treatments applied to wood exposed during construction may contribute to the amount of copper released from CCA-C-treated structures. This paper describes a study in which the release of copper, chromium, and arsenic was compared with end-matched nonstained and prestained CCA-C treated specimens exposed to artificial rainfall. The effect of copper naphthenate end coating on release of copper was also evaluated. The application of prestain prior to CCA-C treatment reduced the release rate of arsenic from the treated wood by approximately 28%. Most of the decrease in leaching appeared to occur early in the test, during the time when arsenic release was greatest. The prestain also appeared to slightly decrease the release of copper and chromium, but these differences were not statistically significant. The application of a copper-naphthenate end coating did significantly increase the amount of copper detected in the leachate. Results from this study indicate that release rate data generated from nonstained CCA-C-treated wood may overestimate the release of arsenic from wood that has been prestained. In addition, results suggest that the application of a prestain may be a valuable tool in minimizing the release of arsenic from CCA-C-treated wood.

Release of Copper, Chromium, and Arsenic From Treated Southern Pine Exposed in Seawater and Freshwater

Lebow, Stan T.; Foster, Daniel O.; Lebow, Patricia K.
1999. Forest Prod. J. 49(7/8): 80–89.

Inverse Determination of Diffusion Coefficient for Moisture Diffusion in Wood

Liu, Jen Y.; Simpson, William T.
1999. *In*: Heat and mass transfer in porous media. Proceedings, 33rd ASME national heat transfer conference; 1999 August 15–17; Albuquerque, NM. New York, NY: The American Society of Mechanical Engineers: NHTC999-40: 5 p.

An Improved Shear Test Fixture Using the Iosipescu Specimen

Liu, Jen Y.; Flach, Dwight D.; Ross, Robert J.; Lichtenberg, Gary J.
1999. *In*: Perkins, Richard, ed. Mechanics of cellulosic materials–1999. Proceedings, ASME joint applied mechanics and materials division meeting; 1999 June 27–30; Blacksburg, VA. New York, NY: The American Society of Mechanical Engineers: AMD–Vol. 231/MD-Vol. 85: 139–147.

A Stress Wave Based Approach to NDE of Logs for Assessing Potential Veneer Quality. Part 1. Small-Diameter Ponderosa Pine

Ross, Robert J.; Willits, Susan W.; von Segen, William; Black, Terry; Brashaw, Brian K.; Pellerin, Roy F.
1999. Forest Prod. J. 49(11/12): 60–62.

Biocide Protection of Field-Drilled Bolt Holes in Red Oak, Yellow-Poplar, Loblolly Pine, and Douglas-Fir

Silva, A.A.; Love, C.S.; Morrell, J.J.; De Groot, R.C.
1999. Forest Prod. J. 49(6): 61–66.

▷ **4. Effect of Moisture Content on Warp in Hardwood 2 by 6's for Structural Use**

Simpson, William T.; Forsman, John W.
1999. USDA Forest Service Res. Pap. FPL–RP–580. 8 p.

Sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), and yellow birch (*Betula alleghaniensis*) 2 by 6's were dried and evaluated for warp as it affects ability to meet softwood dimension lumber grading rule requirements for warp. In the first part of the study, sugar maple was kiln-dried to three levels of final moisture content: 27%, 19%, and 12%. Warp during kiln drying increased as final moisture content decreased. Following kiln drying, the lumber was planed and then equilibrated in 12% equilibrium moisture content conditions. Warp during equilibration generally increased as the final moisture content after kiln drying increased. Crook, bow, and twist did not increase enough during equilibration to cause much structural lumber grade loss from warp. However, the percentage of boards still meeting structural lumber grade limits for cup fell to about 80%. In the second part of the study, sugar maple, red maple, and yellow birch 2 by 6's were air- and predried to 27% moisture content and, in general, did not suffer much grade loss during equilibration.

Air Pressures in Wood Frame Walls

TenWolde, Anton; Carll, Charles G.; Malinauskas, Vyto
1998. *In*: Proceedings, Thermal performance of the exterior envelopes of buildings VII; 1998 December 6–10; Clearwater Beach, FL: 665–675.

Comparison of Test Protocols for the Standard Room/Corner Test

White, Robert H.; Dietenberger, Mark A.; Tran, Hao; Grexa, Ondrej; Richardson, Les; Sumathipala, Kuma; Janssens, Marc
1999. Fire Mater. 23: 139–146.

General

Regional Climate Change in the Southern United States: The Implications for Wildfire Occurrence

Heilman, Warren, E.; Potter, Brian E.; Zerbe, John I.
1998. *In*: Mickler & Fox, ed. The productivity and sustainability of southern forest ecosystems in a changing environment. New York, NY: Springer–Verlag, Inc.: 683–699.

Papermaking and Paper Recycling

Proceedings of the 1998 Recycling Symposium; 1998 March 8–12; New Orleans, LA. Atlanta, GA:TAPPI Press.

Pilot Testing and Recycling Evaluation of Newly Developed Environmentally Benign Pressure Sensitive Adhesives
Abubakr, Said; Bormett, David
1998: 339–345.

Recycling Protocol Using a Pilot Laboratory to Evaluate Pressure Sensitive Adhesives
Bormett, David; Abubakr, Said; Peng, Joe; Kumar, Raj
1998: 346–354.

A Pilot Plant Study of the Recyclability of Pressure Sensitive Adhesives (PSA)
Crossley, Bruce R.; Grimes, David B.; Abubakr, Said; Kumar, Rajendra
1998: 469–473.

Pilot-Scale Evaluation of Environmentally Benign PSA Stamps
Ross Sutherland, Nancy; Shilts, Richard; Spielvogel, Sara
1998: 453–467.

Economic Evaluation of Biopulping

Scott, Gary M.; Akhtar, Masood; Swaney, Ross E.
1998. *In*: Proceedings, 7th international conference on biotechnology in the pulp and paper industry; 1998, June 16–19; Vancouver, BC, Canada. Montreal, Quebec, Canada: Canadian Pulp and Pap. Assoc. Poster presentations Vol. B: B3–B6.

Environmentally Benign Linerless Self-Adhesive Coil Stamps: R&D and Recycling Studies

Tsujimoto, Kim K.; LaBrosse, Paul; Abubakr, Said; Stagg, Tim V.; Donermeyer, Don
1998: 525–535.

Effect of Ultrafiltration Permeate Recycling on Deinking Efficiency of Flexo-Printed Newspapers

Chabot, Bruno; Krishnagopalan, Gopal A.; Abubakr, Said
1998. Progress in Paper Recycl.: 28–38 (August).

Semiannual Patents Review—July–December 1997

McCutcheon, William J.; Blankenburg, Julie
1998. Progress in Pap. Recycl. 67–72 (May).

Enzymatic Removal of Stickie Contaminants

Sykes, Marguerite S.; Klungness, John H.; Tan, Freya; Abubakr, Said
1997. *In*: Proceedings of the 1997 TAPPI pulping conference; 1997 October 19–23; San Francisco, CA. Atlanta, GA: TAPPI Press: 687–691.

Properties and Use of Wood, Composites, and Fiber Products

Volatile Organic Chemical Emissions From Composite Wood Products: A Review

Baumann, Melissa G.D.
1997. The Fibril Angle: 5–12. (Spring)

Injection-Molded Composites From Kenaf and Recycled Plastic

Chow, Poo; Bajwa, Dilpreet S.; Lu, Wen-da; Youngquist, John A.; Stark, Nicole M.; Li, Qiang; English, Brent; Cook, Charles G.
1998. *In*: Proceedings, 1st annual American Kenaf Society meeting; 1998 February; San Antonio, TX: 38–42.

▷ **5. Flake Furnish Characterization: Modeling Board Properties With Geometric Descriptors**

Geimer, Robert L.; Evans, James W.; Setiabudi, Dody
1999. USDA Forest Serv. Res. Pap. FPL–RP–577. 36 p.

Four flake furnishes differing in either target length and width or in production methods were combined and degraded to establish 13 different furnish types. Samples from each furnish type were then examined using image analysis techniques. By ranking the data from smallest to largest, percentile values were obtained for long chord, width, area, and perimeter. Cumulative distribution curves visually presented the difference in these geometric descriptors between furnish types. Data were analyzed to determine the descriptors most useful in predicting the flake alignment potential as well as the board properties of bending modulus of elasticity, shear stress, thickness swell, and linear expansion.

Adjusting Modulus of Elasticity of Lumber for Changes in Temperature

Green, David W.; Evans, James W.; Logan, James D.; Nelson, William J.
1999. Forest Prod. J. 49(10): 82–94.

▷ **6. Some Bivariate Distributions for Modeling the Strength Properties of Lumber**

Johnson, Richard A.; Evans, James W.; Green, David W.
1999. USDA Forest Serv. Res. Pap. FPL–RP–575. 11 p.

Accurate modeling of the joint stochastic nature of the strength properties of dimension lumber is essential to the determination of reliability-based design safety factors. This report reviews the major techniques for obtaining bivariate distributions and then discusses bivariate distributions whose marginal distributions suggest they might be useful for modeling the joint distribution of two strength properties. A bivariate Weibull distribution is chosen to illustrate how its likelihood function can be written under a proof loading scheme, offering the possibility that it can be used to model the joint distribution of two properties that must each be measured using a destructive test.

▷ **7. Monitoring of Visually Graded Structural Lumber**

Kretschmann, David E.; Evans, James W.; Brown, Linda
1999. USDA Forest Serv. Res. Pap. FPL–RP–576. 18 p.

Future timber supply is expected to be derived from improved trees grown on managed plantations to satisfy the increased demand for forest products. This fast-grown resource will tend to be harvested in short-age rotations and will contain higher proportions of juvenile wood compared with wood in current harvests. As a result, current allowable properties may need to be reduced in the future. This report explores four options for monitoring the properties of fast-grown wood and briefly discusses the advantages and disadvantages of these approaches. The recommended multiple-stage sampling approach is illustrated in detail using simulated results based on the North American In-Grade test results for Southern Pine. Details of a "real world" example of monitoring lumber properties currently being conducted by the Southern Pine Inspection Bureau are also presented.

Application of AFM on the Adhesion Studies of Oxygen-Plasma-Treated Polypropylene and Lignocellulosics

Mahlberg, R.; Niemi, H.E.–M.; Denes, F.S.; Rowell, R.M.
1999. Langmuir. 15(8): 2985–2992.

Effect of Oxygen and Hexamethyldisiloxane Plasma on Morphology, Wettability and Adhesion Properties of Polypropylene and Lignocellulosics

Mahlberg, R.; Niemi, H.E. –M.; Denes, F.; Rowell, R.M.
1998. Int. J. Adhesion & Adhesives. 18: 283–297.

Economic Opportunities in Natural Fiber–Thermoplastic Composites

Rowell, Roger M.
1998. *In*: Prasad, Paras N.; Mark, James E.; Kandil, Sherif H.; Kafafi, Zakya, H., eds. Science and technology of polmers and advanced materials—emerging technologies and business opportunities. Proceedings, 4th international conference on frontiers of polymers and advanced materials; 1997 January 4–9; Cario, Egypt. New York, NY: Plenum Press: 869–872.

The State of Art and Future Development of Bio-Based Composite Science and Technology Towards the 21st Century

Rowell, Roger M.
1998. *In*: Proceedings, 4th Pacific Rim bio-based composite symposium; 1998 November 1–18; Borgor, Indonesia: 1–18.

Lignocellulosic/Plastic Composites

Sanadi, Anand; Caulfield, Daniel F.; Rowell, Roger M.
1998. The Fibril Angle: 8–12. (Spring)

Influence of Degree of Polymerization of Cellulose and Hemicellulose on Strength Loss in Fire-Retardant-Treated Southern Pine

Sweet, Mitchell S.; Winandy, Jerrold E.
1999. Holzforschung. 53(3): 311–317.

Using Kinetics-Based Models to Address Serviceability Concerns for Fire Retardant Treated Wood at Elevated In-Service Temperatures

Winandy, Jerrold E.
1998. *In*: Natterer, J.; Sandoz, J–L., eds. Proceedings, of the 5th world conference on timber engineering; 1998 August 17–20; Montreux, Switzerland. Lausanne Switzerland: Swiss Federal Institute of Technology: 794–795.

Wood Products Utilization—A Call for Reflection and Innovation

Youngquist, John A.; Hamilton, Thomas E.
1999. Forest Prod. J. 49(11/12): 18–27.

Recycling of Wood Products

Effect of Damage on the Grade Yield of Recycled Lumber

Falk, Robert H.; DeVisser, Don; Cook, Standen; Stansbury, Dale
1999. Forest Prod. J. 49(7/8): 71–79.

Surface Chemistry

Hexamethyldisiloxane-Plasma Coating of Wood Surfaces for Creating Water Repellent Characteristics

Denes, Agnes R.; Tshabalala, Mandla A.; Rowell, Roger; Denes, Ferencz; Young, Raymond A.
1999. Holzforschung. 53(3): 318–326.

Correlation of Water Vapor Adsorption Behavior of Wood With Surface Thermodynamic Properties

Tshabalala, Mandla A.; Denes, Agnes R.; Williams, R. Sam
1999. J. Appl. Poly. Sci. 73: 399–407.

Timber and Fiber Demand and Technology Assessment

▷ **8. Softwood Lumber Prices for Evaluation of Small-Diameter Timber Stands in the Intermountain West**

Chmelik, John T.; Fight, Roger D.; Barbour, R. James
1999. USDA Forest Serv. Res. Note FPL–RN–0270. 4 p.

This paper reports prices for aggregations of lumber grades that are representative of the quality and volume of lumber produced from small-diameter timber stands in the Intermountain West area encompassing Idaho and Montana and land east of the Cascade Mountain range in Oregon and Washington. Price data are reported for Douglas Fir–Larch, Hem–Fir, ponderosa pine, and lodgepole pine. Forest managers can use the grade aggregations in conjunction with the Financial Evaluation of Ecosystem Management Activities software to evaluate silvicultural treatments for small-diameter timber stands.

Building Codes—Obstacle or Opportunity?

Goetzl, Alberto; McKeever, David B.
1999. Forest Prod. J. 49(9): 12–22.

North American Paper Recycling Situation and Pulpwood Market Interactions

Ince, Peter J.
1998. *In*: USDA Forest Service, Forest Products Laboratory; Hillring, B., Dr., compilers. Recycling, energy, and market interactions. Proceedings, United Nations Economic Commission for Europe Timber Committee workshop; 1998 November 3–6; Istanbul, Turkey. Turkey: Ministry of Forestry: 61–72.

Paper Recyling Legislation and Programs in the USA

Ince, Peter
1998. *In*: USDA Forest Service, Forest Products Laboratory; Hillring, B., Dr., compilers. Recycling, energy, and market interactions. Proceedings, United Nations Economic Commission for Europe Timber Committee workshop; 1998 November 3–6; Istanbul, Turkey. Turkey: Ministry of Forestry: 53–55.

▷ **9. United States Pulpwood Receipts—Softwood and Hardwood, Roundwood and Residues, 1950–1996**

Ingram, C. Denise; Ince, Peter J.; Mehlberg, Ryan L.
1999. USDA Forest Service Gen. Tech. Rep. FPL–GTR–115. 34 p.

Pulpwood receipts at wood pulp mills in the United States for the period 1950 to 1996 are shown in this report. It is an update of the General Technical Report FPL–GTR–73, "United States Pulpwood Receipts: Softwood and Hardwood, Roundwood and Residues, 1950–1989," published in 1993. This report continues as a compilation of published and estimated data based on information from various sources, including the American Pulpwood Association and the USDA Forest Service. Data are presented for the Northeast, North Central, total north, Southeast, South Central, total south, and total west regions of the United States, in both cords and cubic meters. Trends are also shown in the use of hardwoods compared with softwoods and residues compared with roundwood. These historical data were compiled to help develop new pulpwood supply functions for the North American Pulp and Paper Model of the USDA Forest Service.

▷ **10. U.S. Timber Production, Trade, Consumption, and Price Statistics 1965–1997**

Howard, James L.
1999. USDA Forest Service Gen. Tech. Rep. FPL–GTR–116. 76 p.

Statistical information on production, trade, consumption, and prices of forest products in the United States are presented in this report. Although national statistics are dealt with for the most part, some statistics are given for regions, states, and Canada. The tables contain information collected from industry trade associations and government agencies. Some of the tables show data that were derived from mathematical calculations, and some show conversions from different units of measurement. These data are intended for use by anyone associated with the wood-using industry. One of the major uses of this data series is tracking technological change over time. One of the major technology shifts occurring in the wood using industry is the substitution of oriented strandboard for plywood in the structural panel sector. Some of the data show this shift. United States production of structural panels totaled 28.5 billion square feet in 1997. Oriented strandboard production increased from less than 3 billion square feet in 1985 to 10.5 billion square feet in 1997. Plywood production was 20.1 billion square feet in 1985 before falling to 17.9 billion square feet in 1997.

▷ **11. Profile 1999: Softwood Sawmills in the United States and Canada**

Spelter, Henry; McKeever, Tim
1999. USDA Forest Serv. Res. Pap. FPL–RP–579. 76 p.

More than 1,200 sawmills produce the bulk of U.S. and Canadian softwood lumber. The maps and tables in this report show the location and size of these mills by State and Province. Analysis of timber inventories in relation to use shows a close correspondence between pricing and use intensity. In some Southern States, the intensity of use is approaching recent growth levels, but the adoption of more intensive management coupled with maturing of large areas of newly established forests should increase supply over the next two decades.

Wood Anatomy and Identification

Xylaria at the Forest Products Laboratory: Past, Present, and Future

Miller, Regis B.
1999. *In*: Maes, Freddy; Beeckman, Hans, eds. Wood to survive. Royal Museum, Central Africa, Tervuren, Belgium. Annual Sciences of Economics. 25: 243–254.

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